808–500W Pulsed Laser

Up to **500 W** of lighting power

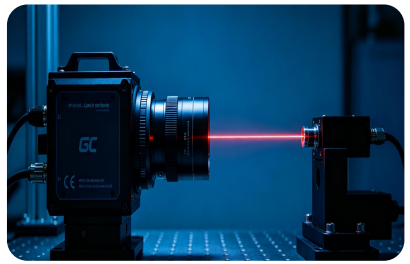
The pulse frequency can reach up to **1 MHz**

The maximum duration of single pulse can reach up to **1 μs**

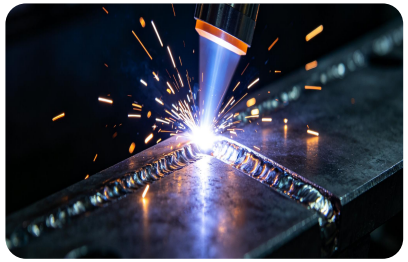
Industrial-grade integrated design:
laser optical system + high-speed drive circuit + temperature control system

Design Objective of The Pulsed Laser:
To Capture Ultra-high-speed Phenomena Without Motion Blur.

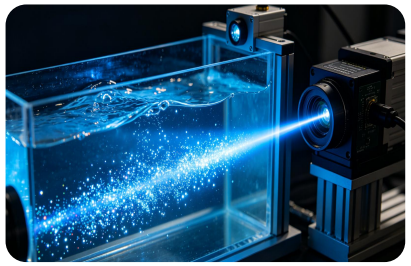
High-speed Imaging Applications



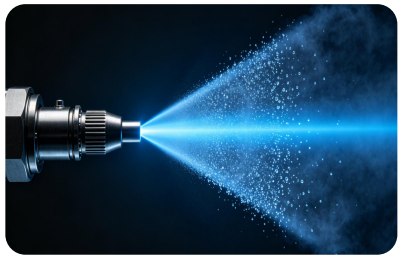
Laser Cladding Welding



Particle Measurement



Spray Diagnosis



A common challenge one encounters is how to "capture" a fleeting physical process.

Ballistic flight, melt pool splashing, fuel atomization, and particle motion—these phenomena occur on microsecond or even nanosecond timescales, making them difficult to capture with conventional illumination.

Distinction	High-speed Imaging	Welding and Laser Cladding	Particle Measurement	Spray Diagnosis
Continuous-Wave Laser	If the exposure time is not sufficiently short, a fast-moving object will exhibit motion blur; prolonged exposure, on the other hand, can lead to thermal accumulation.	The heat-affected zone is relatively large, which can easily lead to deformation and cracking; therefore, this method is unsuitable for welding precision materials.	For high-speed particles, only single-point or statistical information can be obtained, making it difficult to capture the transient flow field structure.	Prolonged exposure may cause droplets to evaporate or induce thermal effects.
Pulsed Laser	The peak power setting results in high single-pulse light intensity, enabling excellent signal-to-noise ratios even under short exposure times, making it well-suited for synchronous operation with high-speed cameras.	Energy is intermittently supplied in pulse form to reduce thermal damage to the substrate.	Short pulses enable clear recording of the instantaneous position of particles.	Short pulses can freeze high-speed droplets, enabling clear visualization of droplet distribution and velocity fields.

Laser Product Overview

Integrated Design: Four modules housed within a single chassis

Laser optical system

Emitting 808 nm pulsed light

High-speed drive circuit

Convertting the trigger signal into a nanosecond flash.

Temperature controlling system

Cooling + Overtemperature Protection

Intelligent logic control

Emergency Stop, Interlocks, and Status Management

Key Parameters

Items	Specifications	Detailed Information
Wavelength	808nm±5nm	Infrared Light
Peak Power Output	500W	Instantaneous power of a brief flash
Trigger Delay	70 ns ± 10 ns (from the onset of the optical pulse)	A fixed delay is applied from trigger to light output.
Pulse Width	50ns~1μs（recommended 100~500ns）	How long does each flash last?
Repeat Frequency Rate	Up to 1 MHz (recommended ≤ 500 kHz)	Maximum number of flashes per second
Work Pattern	Pulse mode，CW not supported	CW mode is not supported

Electrical triggering and pulse characteristics

External Trigger Signal

Triggering method: external TTL-level 5V rising-edge trigger
Input impedance: 50 Ω or 1 MΩ selectable
Interface type: Front-panel Trigger BNC interface

Pulse Width

Range: 50 ns – 1 μs; recommended range: 100 ns – 500 ns
Below 50 ns: pulse distortion, power degradation
Exceeding 1 μs: irreversible damage to the drive circuit (risk exists even with a single pulse)

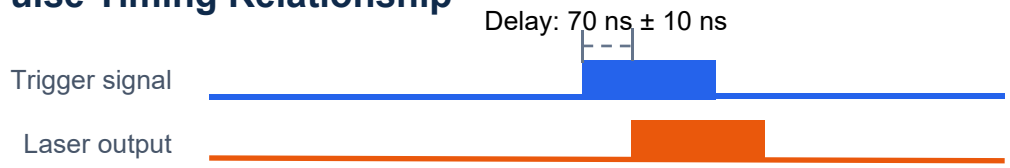
Repeat Frequency Rate

Upper limit: 1 MHz; for long-term stable operation, a recommended limit is ≤ 500 kHz
Exceeding the upper limit may lead to pulse loss or trigger instability
High-frequency operation requires a comprehensive evaluation

Duty Cycle Limitation

Recommended value: ≤ 2%
Exceeding 2%: power drops significantly, with maximum attenuation reaching 80%
Exceeding the duty cycle limit results in narrowed pulse width; the underlying mechanisms of these two phenomena differ.

Pulse Timing Relationship



When a trigger signal is applied, a fixed delay is introduced before the optical pulse begins, and the pulse width is determined by the external signal.

Currently, mainstream high-speed cameras feature internal delay adjustment capabilities, and the respective camera manufacturers incorporate dedicated delay processors, enabling precise synchronization without the need for additional design steps.

Pulse Width, Frequency, and Duty Cycle: The Relationship Between These Three Parameters

Duty cycle = Pulse Width × Frequency

The "two-of-three" principle: given any two parameters, the third is uniquely determined.

Frequency	Pulse Width（ns)	Duty Cycle	Peak Power
10kHz	100ns	0.1%	350W
	200ns	0.2%	530W
	500ns	0.5%	680W
	800ns	0.8%	725W
	1000ns	1%	720W
50KKz	100ns	0.5%	340W
	200ns	1%	530W
	300ns	1.5%	493W
	400ns	2%	370W
	500ns	2.5%	296W

Frequency	Pulse Width（ns)	Duty Cycle	Peak Power
80kHz	100ns	0.8%	347W
	200ns	1.6%	450W
	300ns	2.4%	300W
100kHz	100ns	1%	340W
	200ns	2%	360W
500KHz	50ns	2.5%	168W
	60ns	3%	196W
1MHz	30ns	3%	30W
	40ns	4%	57W
	50ns	5%	94W

Exceeding the duty cycle limit results in a reduction of the pulse width; the underlying mechanisms of these two phenomena differ.
When operating at high frequencies, a comprehensive assessment of the duty cycle is required.

Comparative Analysis of Different Products

CNI · 808nm 500W

All-in-one system, plug-and-play; designed for industrial integration and prolonged high-speed imaging.

808 nm infrared · 500 W peak power
1 MHz · Duty cycle ≤ 2%

Parameter	CNI. (808 nm)
Peak Power	500W
Wavelength	808±5nm
Standard Fiber Optic Cable	Liquid-core fiber (core diameter: 5 mm)
Pulse Length	50 ns – 1 μs (recommended: 100–500 ns)
Maximal Frequency	1 MHz (recommended ≤ 500 kHz)
Maximum Duty Cycle	≤2% (during prolonged operation)
Trigger Delay	70ns ± 10ns
Trigger Interface	TTL 5V · BNC
Power Supply Mode	15V DC (customizable 15–24V)
System Architecture	Highly integrated standalone unit

Usage Method

① Power supply: Connect the 15V DC power supply to the 4-pin header interface on the front panel.

② Power On: Switch the ON/OFF switch to ON; the Power indicator light will illuminate.

③ Standby: Insert the key and rotate it to the standby position; the Ready and Laser indicators will illuminate.

④ Connection trigger: Camera/Controller → Panel Trigger (BNC) interface

⑤ Light Output: When a TTL external trigger signal is sent, the laser immediately emits light.

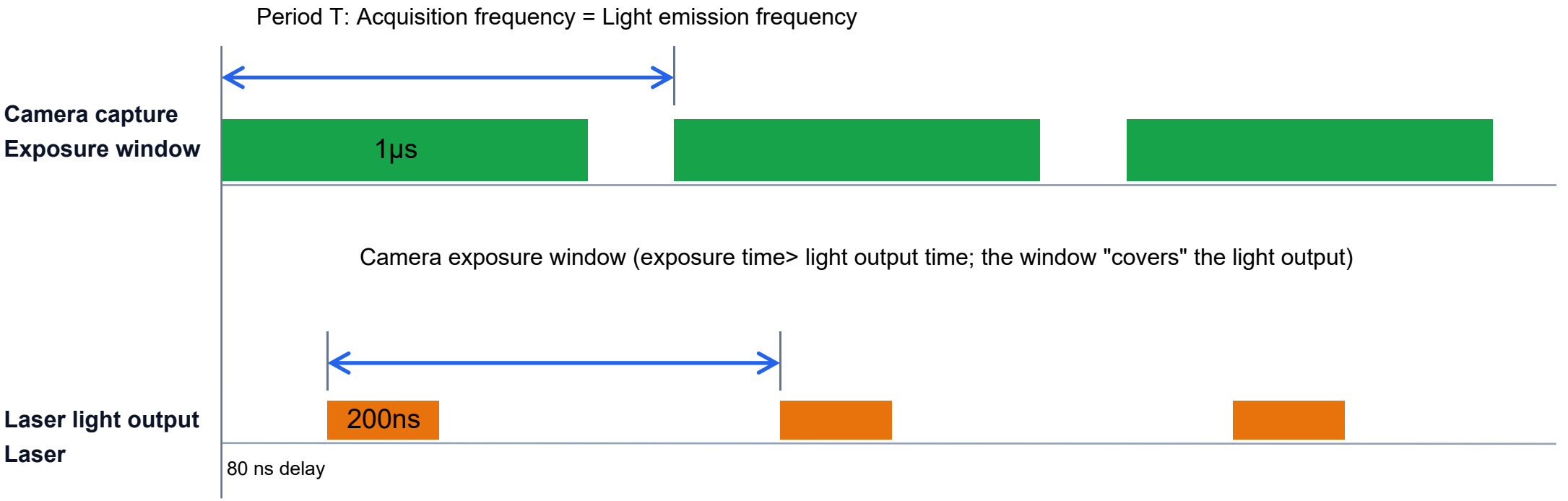
⑥ Power off: stop the trigger signal → perform key reset → turn off the power switch

Product Front Panel :
Mechanical Function Buttons and Interfaces

Key Concept: The key serves solely as the standby enable switch for the entire device, rather than being a dedicated light-activation button. Actual light activation requires an external TTL trigger signal; this design ensures that accidental operation only enters standby mode, significantly enhancing the devices operational safety.

Camera synchronization laser: Synchronization timing — identical frequency + longer exposure time = full capture of all emitted light

The cameras sync signal triggers the laser: acquisition frequency = emission frequency; camera exposure time ≥ laser emission duration, ensuring that the entire emission period falls within the exposure window.



① Identical frequency: Acquisition frequency = emission frequency; each trigger pulse corresponds to one emission event, ensuring frame-to-frame alignment and seamless frame progression.

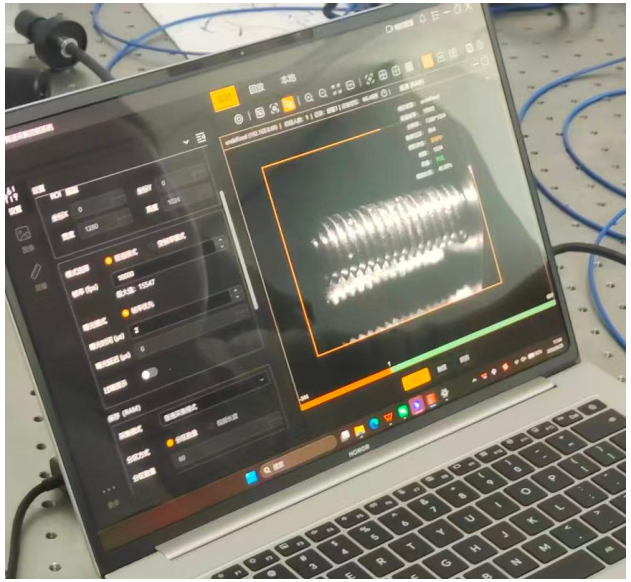
② Window coverage: When the camera exposure time is greater than or equal to the laser emission time, the emitted light fully falls within the exposure window; the 80 ns trigger delay is negligible, ensuring the integrity of data acquisition.

Experimental Test: High-Speed Camera and Pulsed Laser Illumination System

Experimental Parameters

Parameter	High-speed camera	Laser
Sampling frame rate	10000fps	10000fps
Frame acquisition time	2μs	1μs

Test Results

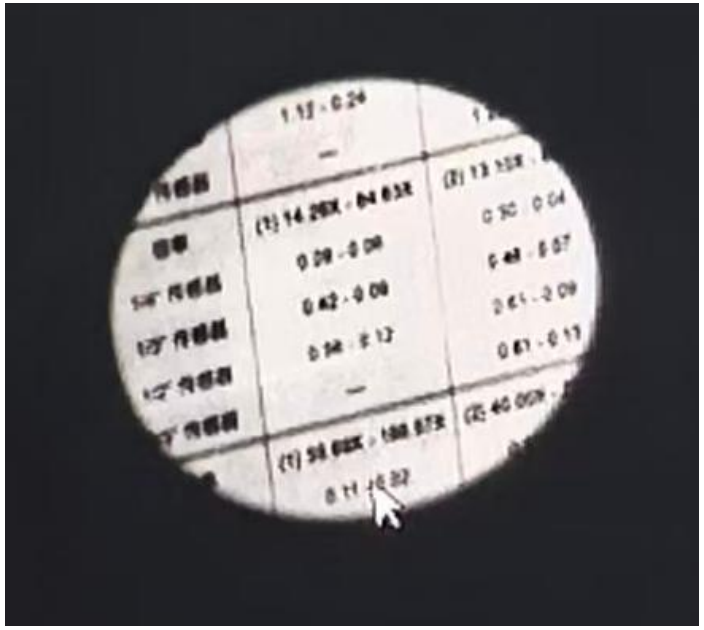


Experimental Test: High-Speed Camera and Pulsed Laser Illumination System

Experimental Parameters

Parameter	High-speed camera	Laser
Sampling frame rate	100000fps	1000000fps
Frame acquisition time	1μs	200ns

Test Results



Product Summary – 808 nm – 500 W Pulsed Laser

Core Advantage

- **Integrated system design, plug-and-play capability, optimized for industrial long-duration high-speed imaging.**
- **TTL external trigger, synchronized and stable, frame-by-frame alignment for high-speed cameras**
- **Continuous pulse output, not burst pulse trains; no repeated retriggering required.**
- **808±5 nm infrared, 500 W peak power**
- **Frequency up to 1 MHz, pulse width from 50 ns to 1 μs**

Industrial-grade integrated design
Laser optical system + high-speed drive circuit + temperature control system